

highly esteemed by the Romans, as we know from Juvenal; but there are no grounds for imagining that it was in those times imported into Rome from Britain. The facility of transport was not then so great as it is at present; and a gamy flavour was probably not so much relished by the Romans as it is said to have been by our King George the First, who preferred oysters a week old at Hanover to those which he afterwards got in England.

Within the last few years the "periwinkle" (*Littorina litorea*, L.), which is a favourite delicacy of our poorer classes, has spread with unusual rapidity along the eastern shores of the North American continent. Mr. Arthur F. Gray, in *Science News* for April, 1879, attributed its origin to Europe. It certainly does not seem to have been observed in America by Gould or any other conchologist before 1870.

Preeminent among land shells, as a dainty article of food in France, is *Helix pomatia*, L. We are more fastidious or more conservative in our gastronomic notions. It is a mistake to suppose that the Romans, when they possessed and inhabited Great Britain, brought this snail with them to indulge their luxurious tastes. In all probability it was not even known to them, because another species (*H. lucorum*, Müller) takes its place in Central Italy. *H. pomatia* has not been found at Wroxeter or York, or in any other part of England or Wales where the Romans built cities or had important military stations. Among the debris of an extensive Roman villa discovered in Northamptonshire, in which the shells of cockles, oysters, mussels, and whelks abounded, not one of *H. pomatia* occurred, although at Woodford, a few miles distant, that species is plentiful in a living state.

J. GWYN JEFFREYS

THE ALFIANELLO METEORITE

SIGNOR DENZA, Director-General of the Italian Meteorological Association, sends us an account of the remarkable aerolite which fell in the province of Brescia on February 16, and to which we referred last week. On that date, at 2.43 p.m. local time, a strong detonation was heard in many places of the province of Brescia and even in the neighbouring provinces of Cremona, Verona, Mantua, Placenza, and Parma. The detonation was quite awful in the commune of Alfianello, in the district of Verolanuova, Brescia. This was found to be caused by a meteorite which exploded a few hundred yards above Alfianello. A peasant saw it fall in the direction of N.E. to S.W., or, more exactly, N.N.E. to S.S.W., at a distance of about 150 yards. When the meteoric mass fell to the earth, it produced on the ground, in consequence of the transmission of the shock, a movement similar to that of an earthquake, which was felt in the surrounding districts; the telegraph wires oscillated and window frames shook. Before the meteorite fell a confused commotion was seen in the sky, and immediately after a prolonged noise was heard similar to that of a tram moving rapidly along the rails. No light was seen; but the meteor must have been accompanied, as usual, by a light vapour, produced by the volatilisation of the substance melted at the surface; for some of those who saw it fall compared it to a chimney falling from the sky, and surmounted by a wreath of smoke. The meteorite fell in a field about 300 yards south-west of Alfianello. It penetrated the ground obliquely, nearly in the same direction as it was seen moving in the air, from east to west, sinking to the depth of about a yard, deducting the height of the meteoric mass. The peasants who saw it fall and who were the first to touch it, found it somewhat hot. The meteorite fell entire, but unfortunately was soon broken to pieces and carried away by the crowd who gathered to see the strange sight. The form was ovoid, but a little flattened at the centre; the under part was

broad and convex, presenting the form of a cauldron; the upper part was truncated. The surface was covered with the usual blackish crust, and studded with small concavities, partly separate, partly grouped together.

As to the dimensions and weight of the aerolite, the estimates differ. According to the evidence of some, its height was about 75 centimetres, greatest breadth 60 centimetres, and its volume about 25 cubic decimetres. Its weight has been variously estimated at 50, 100, 200, and 250 kilograms. Its real weight was probably not much under 200 kilograms. It is certain that Prof. Bombicci carried more than 25 kilograms to Bologna, to add to the rich collection of meteorites in the Mineralogical Museum of the University; that a specimen weighing 13½ kilograms was taken possession of by MM. Ferrari, the owners of the field in which the meteorite fell; that about 40 kilograms remained in possession of other persons; that the municipality of Alfianello sent a specimen of 5 kilograms to the Athenæum of Brescia; and that two pieces weighing 12 kilograms each were thrown into a stream and lost; without speaking of a considerable quantity of small fragments, distributed here and there, of which Signor Denza possesses four, of a total weight of 39 grammes.

By its structure the Alfianello meteorite belongs, according to Prof. Bombicci, to the sporosiderite-oligosiderite group, being almost identical with the New Concord (Ohio) meteorite. The substance is finely granulated, of an ashy grey; the bright glossy surface has elements showing varied gradations of colour. Metallic particles abound; they are found scattered like small nuclei, in which are iron and perhaps one of its alloys, in brilliant crystalline aggregations, of a yellowish or bronze white. Circles of rust of a yellowish brown rapidly form around the particles of iron. In the places where there are no metalliferous nuclei, the grains of iron are attached to the stony portion in the proportion of 68 per 1000 of weight. The blackish crust is rough, and to some extent rugged in some parts of the surface, and rather smooth and uniform in others; in general it is somewhat lustrous. The total specific weight of the stone is from 3.47 to 3.50. The chemical analysis of the meteorite is being made in two different laboratories at Bologna. Signor Denza's information has been obtained from Prof. Bombicci of Bologna University, and from Professors Briosi, Ragazzoni, and Casali of Brescia.

THE SHAPES OF LEAVES¹

IV.—Special Types in Special Environments

FROM the previous papers it will be clear that degree of subordination to the stem accounts in large measure for the extent to which leaves vary from the primitive ovate-lanceolate type. Where they are still so most subordinated, there will be a strong tendency towards the long pointed ribbon-like form, and also a marked inclination towards decurrence. This combination of peculiarities is well seen in several thistles, and in comfrey, as also to a less extent in many epilobes and stellarias. Compare *Verbascum thapsus*, and other mulleins. From these extreme cases, in which leaf and stem are not fully differentiated from one another, one can trace several gradations, through square stems with sessile leaves (as in certain St. John's worts) up to merely sessile stem-leaves, or leaves that clasp the stem with pointed or rounded auricles. Wherever lines exist along the stem, they may be observed in pairs up to the point where a leaf is given off, and they are undoubtedly surviving marks of the primitive unity of stem and leaf. The same may be said of rows of hairs, like those of *Stellaria media* and of *Veronica chamaedrys*. There can be little doubt

¹ Concluded from p. 495.

that special selective causes (protection against creeping insects, &c.) have often come into play in preserving or modifying such decurrent wings, stem-lines, auricles, clasping stipules, and rows of hairs; but as a whole they nevertheless point back distinctly to the origin of dicotyledonous stems from superposition of leaves and midribs upon one another. They are rudimentary forms of stem-lamina.

Sessile leaves are particularly apt to be lanceolate. They approach nearest among dicotyledons to the monocotyledonous type. The botanist will readily fill in examples for himself.



FIG. 34.—White Deadnettle (*Lamium album*).

On the other hand, it is clear that the conditions under which leaves assume the orbicular and peltate types can only occur where there is least subordination to a central stem. And these conditions must have occurred for immense numbers of generations in order to overcome the ancestral tendency towards the lanceolate or ovate form. For a leaf must first pass through a cordate or reniform stage, like that of the coltsfoots, before it can reach an orbicular shape, like that of our common waterlily; and even when it becomes completely circular, like the *Victoria regia*, it may still retain a mark of junction where the

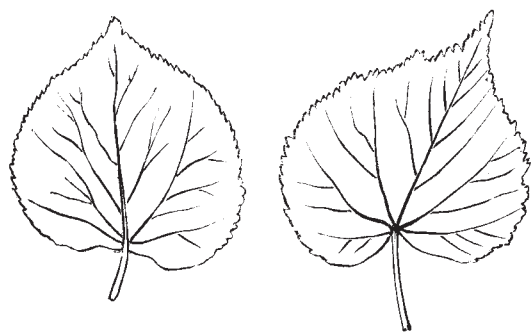


FIG. 35.—Lime.

overlapping edges have met without becoming connate. In the case of *Victoria regia* the transformation has been traced during germination. The first leaves produced by the young plant are linear and submerged; the next are sagittate and hastate; the later ones become rounded, cordate, and orbicular; and even when they assume the peltate form, the line still marks the point of union. This sufficiently accounts for the rarity of perfectly peltate leaves, such as those of *Tropæolum*, *Hydrocotyle*, and *Podophyllum*. Radical leaves growing on long footstalks will be oftenest orbicular cordate; stem-leaves on the same plant may pass from ovate-cordate to ovate, lanceo-

late, and linear. Large cordate radical leaves will be most frequently produced from perennials with richly-stored rootstocks. The sagittate and pointed leaves of *Arum* and *Sagittaria* show the furthest step attained in the same direction by monocotyledonous foliage, starting from the liliaceous form.

Where the stem, or, what comes practically to the same thing, solitary ascending branches, rise high into the air, especially with opposite leaves, we get a common type which may be well represented by the white deadnettle



FIGS. 36 and 37.—Begonias.

(Fig. 34). Hedgerow plants with perennial stocks frequently assume this type. It reappears almost identically, under the very same conditions, in so distant a group as the true nettles; and though it is possible that the causes which produce mimicry in the animal world may here have come somewhat into play, so as to modify sundry *Lamiums* into the similitude of the protected *Urtica*, yet the analogy of other Labiates shows that the circumstances alone have much to do with producing the resemblance. For a great many tall-stemmed hedgerow Labiates closely



FIG. 38.—Cow-parsnip.

approximate to the same type: for example, *Lamium galeobdolon*, *Ballota nigra*, *Galeopsis tetrahit*, *Stachys silvatica*, and *S. palustris*. Compare, *mutatis mutandis* for ancestral peculiarities, the other hedgerow plants, *Scrophularia nodosa* and *Alliaria officinalis*. On the other hand, notice the orbicular long-stalked lower leaves of the latter (especially when biennial) side by side with the lower leaves of some Labiates, such as *Nepeta glechoma*. Indeed, the Labiates as a whole present an excellent study of local modification in an ancestral type,

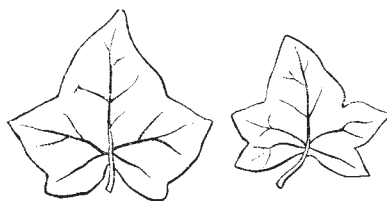


FIG. 39.—Creeping leaves of ivy.

according to habit and habitat. Take as other groups of this family the following: first, *Mentha* and *Lycopus*; then, *Salvia pratensis*, *Prunella*, *Marrubium*, radical leaves of *Ajuga reptans*, and lower leaves of *Nepeta glechoma*; finally, the typical form dwarfed in little prostrate retrograde types, such as *Thymus serpyllum* and *Mentha pulegium*. Compare these last with other prostrate or dwarfed types elsewhere, like *Veronica serpyllifolia*, *Peplis portula*, *Hypericum humifusum*, *Montia fontana*, and *Arenaria serpyllifolia*.

As grassy types, the best familiar examples are those

of the flaxes, *Stellaria graminea*, Toadflax, Bastard Toadflax, &c.; all of which have been largely influenced by monocotyledonous competition. Even a pea, *Lathyrus missolia*, has got rid under such circumstances of its leaflets, and has flattened its petiole into a grass-like blade. Intermediate forms occur in Southern Europe. The peas, indeed, are papilionaceous plants which have largely cast off their ancestral leaf-type, in order to avail themselves of new conditions. *L. aphaca* has lost its leaflets, and flattened and enlarged its stipules so as to resemble simple opposite leaves; and *L. hirsutus* and *pratensis* have reduced the leaflets to one long almost

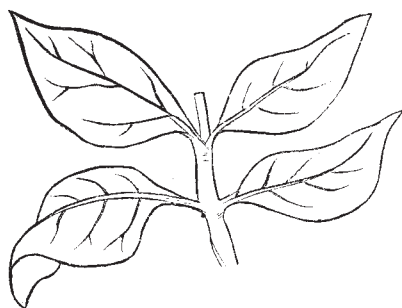


FIG. 40.—Ascending leaves of ivy.

linear pair. Marshy plants have also often been forced into adopting grass-like forms. The great spearwort is a swampy buttercup, whose ancestral leaf has been lengthened out into a long ribbon, with almost parallel ribs; the lesser spearwort shows the same tendency to a less degree, still retaining ovate lower leaves, with lanceolate upper ones; and *Veronica scutellata* is a similar marshy case among the Scrophularineæ.

When the tree-like form is attained, or free access to air is otherwise gained (as by climbers), the supply of carbon, being practically unlimited, becomes relatively little important, and the supply of sunlight assumes the

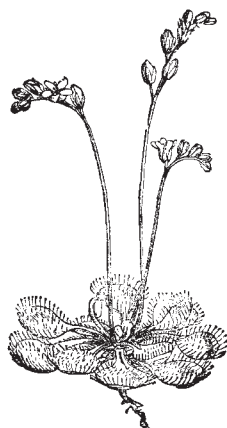
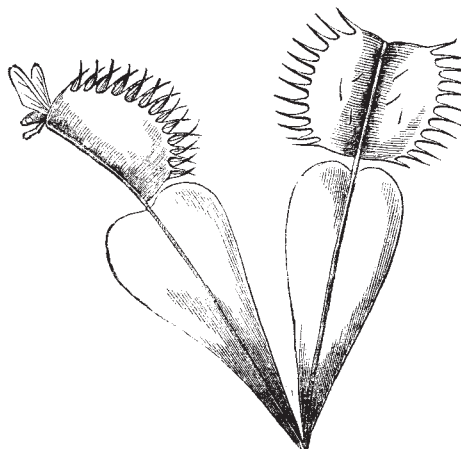


FIG. 41.—Sundew.

first place in the economy of the plant. Under such conditions, the great object must be to prevent the leaves from overshadowing one another. Now this result may be obtained in a great number of ways, and we must not expect that every tree or shrub will solve the problem for itself in exactly the same fashion. It is enough that the shape into which the ancestral form is finally modified should sufficiently answer the purpose in view. As a matter of fact, the suitability of the actual forms and arrangements of tree-leaves to the functions they have to perform can be readily tested by observing any tree in bright sunshine. On the one hand, almost every leaf is in

full illumination, no leaf unnecessarily shading its neighbour; and on the other hand, there is hardly any interspace between the leaves, as may be seen by the fact that the shadow thrown by the tree as a whole is almost perfectly continuous. In short, there is no waste of chlorophyll, and there is no waste of sunshine.

Mr. Herbert Spencer has called attention to the results of varying exposure to light in the various parts of the same leaves, which often causes them to become unequally developed. In the lime (Fig. 35) such obliquity is normal. In the various *Begonias* (Figs. 36 and 37) the resulting asymmetry is very noticeable. In the cow-parsnip (Fig. 38) it is the leaflets of the same leaf which are asymmetrically developed, so as not to overshadow one another. In more symmetrical leaves, there is an equal provision for preventing overshadowing, only here it takes the form of indentation of the edge, as in the oak, or of subdivision into leaflets, as in the horse-chestnut. In the latter case, indeed, the two outermost leaflets are habitually asymmetrical. On the whole, however, the mass of forest trees in temperate climates have almost entire leaves; and full exposure to sunlight is secured rather by their special specific arrangement at the end of the minor branches. Most often they are more or less ovate, as in the elm, beech, alder, birch, and poplar. Where the

FIG. 42.—*Dionaea*.

leaves are divided, the separate leaflets assume the appearance of almost entire leaves: compare the leaflet of the horse chestnut with the leaf of the true chestnut; the leaflet of the ash with the leaf of the hornbeam; the leaflet of the walnut with the leaf of the beech; and the leaflet of the mountain ash with the leaf of the black-thorn. In all these cases, almost identical results are practically produced in the end by similar circumstances acting upon wholly unlike original types.

Some minor typical forms exist in certain groups of climbers, which are worth a moment's notice. Take as an example the creeping leaves of ivy. As long as this plant grows close to a wall or the trunk of a tree it assumes the well-known shape shown in Fig. 39. But as soon as it branches out its flowering sprays into the open, acquiring a tree-like habit, which it often does on the top of a wall, it takes a simpler and totally different form of leaf, as shown in Fig. 40, growing on the same plant. This last type is quite comparable to that of the pomegranate. That both types admirably suit their particular situation can easily be seen by noting how well they fit in with one another without overshadowing. It would be difficult to point out the geometrical grounds for this relation, but the relation itself becomes obvious on watching an ivy-plant in broad sunshine. Moreover, the first or truly ivy-like form of leaf tends to recur among

many plants which similarly press close to a flat surface. In *Veronica hederifolia* we get it in a weed that climbs over banks of earth; in *Linaria cymbalaria* we get it in a trailer hanging upon stone walls; in *Campanula hederacea* and *Ranunculus hederaceus* we get it in a creeper along the edge of rills or over soft mud. Compare in each case other forms of the typical generic leaf, as seen in germander speedwell, toadflax, harebell, and meadow buttercup.

Another special climbing type, proper to more open habits of twining round alien stems, is that of the common bindweed. This, the ordinary convolvulus form, reappears exactly in so distant a plant as *Polygonum convolvulus*, whose habits are exactly similar. Even among monocotyledons we get it closely simulated by *Smilax*, with precisely like conditions, and somewhat less closely by *Tamus*. Indeed, this form of leaf may be said to be almost universal among lithe twining creepers.

The hop type belongs rather to mantling than to mere twining climbers. It reappears under identical conditions in the vine, and less closely in true bryony. More subdivided into leaflets, it produces the Virginia creeper, and many forms of clematis.

Among ground plants, it is only possible very briefly to refer to the succulent types which abound in dry situations. A regular gradation may here be traced from rich forms with rather thin, flat, ovate leaves, growing in favourable situations, like *Sedum telephium*, through dwarfish forms, with oblong leaves, like *Sedum album*, to forms with knobby, globular leaves, growing in very dry spots, like *Sedum anglicum*. Where the stem becomes very succulent, the leaves may be dwarfed out of existence altogether, or reduced to prickles, as in those dry desert plants, the cactuses. Compare some tropical Euphorbias. Miscellaneous examples of these dry types are also found among Mesembryanthemums and other Ficoideæ, natives of hot, sandy plains in South Africa. The succulence here acts as a reservoir for water. Special precautions are taken against evaporation. We see the first symptoms of such a habit in some English dry-soil saxifrages.

Proximity to the sea, whether the plant grows in sand or mud, also tends to produce succulence. This effect is seen casually in many seaside weeds, and habitually in such cases as samphire, *Inula crithmoides*, *Spergularia rubra*, *Cakile maritima*, and common scurvy-grass. *Suaeda maritima* is in this group the exact analogue of *Sedum anglicum*, while *Salicornia* is similarly the analogue of the leafless cactuses. Compare also *Salsola kali*. There is a somewhat similar tendency to fleshiness in certain freshwater weeds of moist spots, such as *Chrysosplenium*, and many saxifrages.

In such a brief sketch as the present it is impossible to do more than allude in passing to sundry more special developments of leaves, for protective or other purposes. One development of this character is seen in the growth of prickly tips (*Agave*, *Aloe*, *Salsola*, *Juncus acutus*, *Bromelia pinguin*), or of prickly edges (thistles, *Carlina*, holly, *Stratiotes*, *Dipsacus*, *Rubia peregrina*). Such prickles may be purely defensive, or they may assist the plant in clambering (*Stellata*, *Smilax*, hop). Again, the leaf as a whole may be reduced to a prickle, as in gorse, where the very young seedling has trefoil leaves like its allies; but these give way gradually to entire lanceolate blades, and finally to mere thornlike spines. Another very different development is that of the insect-eating plants, which grow in very boggy spots, and so require animal matter not yielded them by the roots. Our English sundew (Fig. 41) is an example of the first step in such a process; essentially its leaves belong to the obovate tufted or rosetted type represented by the daisy, only a little exaggerated; but they have been specialised for the insect-eating function by the evolution of the little glandular hairs. Even simpler is the type of the butterwort,

which belongs to the same foliar class as the London Pride, *Draba aizoides*, *Samolus Valerandi*, *Sempervivum tectorum*, &c., but with the edges folded over so as to inclose its insect prey. From these simple forms we progress at last to highly specialised types like *Dionaea* (Fig. 42), *Sarracenia*, *Darlingtonia*, *Nepenthes*, and *Cephalotus*. Once more, the connate form in opposite leaves (*Dipsacus*, *Chlora*) or the perfoliate in alternate ones (*Bupleurum*) may be due, as has been suggested, to the facilities these arrangements afford for storing a little reservoir of water, which acts as a moat to protect the flowers from climbing ants. But such minor selective actions are too numerous and too diversified to be noticed in full here; it must suffice to point out the general principles upon which the forms of leaves usually depend, leaving the reader to fill in the details in every case from his own special observations.

GRANT ALLEN

FOSSIL ALGÆ¹

THE publication of Saporita and Marion's "Evolution of the Cryptogams" (see NATURE, vol. xxiv. p. 75, 558) has been followed by a work in which Dr. Nathorst has endeavoured to prove that nearly the whole of the supposed fossil marine Algæ, especially from the older rocks, are either tracks of Invertebrata or were produced by mechanical agency. "Florideæ, Laminariæ, Chondriteæ, Alectorurideæ, Arthrophyceæ, Bilobites, and other algæ; comprising among them forms curious and remarkable by the regularity of their branching thallus, their phyllome with raised periphery and striated surface; all had disappeared as if by enchantment, and in their place there remained but tracks of Invertebrata, moving upon the ooze, swimming or creeping, and impressing the extremities of their tentaculary palpæ around them, or of larvæ gliding through the slimy mud." When these are insufficient, the movement of water acting on inert bodies, or waving tufts of sea-weed, are appealed to, for no fossil imprint either sunk or in relief, unless preserving carbonaceous matter, is admitted in Dr. Nathorst's hypothesis to have ever been a plant. This view is energetically combated by Saporita in the present work. The issue however does not very materially affect either the general theory of plant-evolution, as traced by Saporita and Marion, since this relies but little upon the evidence of doubtful fossil algæ, or the succession of marine algæ in time, which seems to have been probably Laminariæ, Fucacæ, and Florideæ. The main point in dispute is whether the supposed primordial algæ, Eophyton and Bilobites, are of vegetable or of other origin. There are numerous *a priori* reasons for supposing plant life to have existed in palæozoic seas, and the complexity of life seen in even the older rocks renders their presence almost a necessity. The question is whether certain impressions which are abundant in Silurian rocks reproduce some of these forms, or whether we are still without indications of the primæval algæ.

Dr. Nathorst appears to rely very greatly upon the fact that many of these supposed sea-weeds are marked in relief upon the under-sides of slabs, proving, as he supposes, that they are the filling-in of furrows, and also upon the very general disappearance of all trace of carbon. In denying the plant-origin of certain impressions lately described as algæ by Prof. Walter Keeping in the *Geological Magazine*, he lays particular stress on the former hypothesis. Saporita however devotes two or three pages to clearing up this, as he believes, misconception. The fact that very unmistakable impressions of even terrestrial plants do occur in this condition, is known to most collectors of them, and is explained by the author as follows:—A plant-stem of sufficient sub-

¹ "À propos des Algues Fossiles." Le Marquis de Saporita. (Paris: G. Masson, 1882.)